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MALVERN NANO ZS PARTICLE SIZE COMPARISON WITH THE INTEGRATED VIRUS DETECTION SYSTEM (IVDS)

Charles H. Wick

RESEARCH AND TECHNOLOGY DIRECTORATE

Patrick E. McCubbin



OptiMetrics, INC.
Research & Engineering

OPTIMETRICS, INC.
Abingdon, MD 21009

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PREFACE

The work described in this report was started in August 2009 and completed in September 2009.

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MALVERN NANO ZS PARTICLE SIZE COMPARISON WITH THE INTEGRATED VIRUS DETECTION SYSTEM (IVDS)

1. INTRODUCTION

The Malvern Nano ZS measures zeta potential or electrophoretic mobility for fine particle systems in solution, including bacteria and viruses. The characterization of the surface of microorganisms is determined by analyzing the surface charge and layer effects of bacteria and viruses. The system can assess the stability of biological organisms in suspension and emulsions and explore metabolic changes in organisms due to either matrix or environmental variables. Various parameters such as pH, ion interactions, solution composition, and other in vitro parameters can affect the surface charge of the species in question. The non-disruptive analysis leaves organisms intact for further sample analyses.

The system also uses a non-invasive back scatter (NIBS) technology for particle analysis and size distribution. The NIBS technology tests biological materials in solution, using a small sample size, without disrupting the sample.¹

Particle Size Measurements

A series of samples were analyzed for particle size with the Malvern instrument. The following polystyrene latex (PSL) particles, from Bangs Laboratories, were measured: 20 nm, 30 nm, 70 nm, 90 nm, 30 nm plus 90 nm, and 30 nm plus 130 nm. The samples were also measured with the Integrated Virus Detection System (IVDS)² as a comparison.

The Malvern instrument analyzed the 20 nm, 30 nm, 70 nm, and 90 nm particles, and the scans are shown in Figures 1, 3, 5, and 7, respectively. The value for Z-Avg in the table in each figure is the diameter result in nanometers. The IVDS measured the 20 nm, 30 nm, 70 nm, and 90 nm particles, and the scans are shown in Figures 2, 4, 6, and 8, respectively. The resultant size from the IVDS is listed on the graph. The IVDS and the Malvern instrument are in close agreement for the major peak of the PSL standards. The IVDS instrument does show a smaller extra peak in the 70 and the 90 nm size standard that is not shown in the Malvern analysis.

To examine the ability to differentiate several peaks in both instruments, two mixed standards were prepared. A 30 nm plus 90 nm sample was mixed in a 1:3 ratio by volume (where 30 nm=1). The Malvern analysis of the 30 nm plus 90 nm sample is shown in Figure 9. The Z-Avg was determined to be 79.23 nm with only one peak shown. The IVDS detected both standards in Figure 10. Conversations with Malvern technical support indicate that there needs to be an approximate 3X difference in size for their instrument to differentiate peaks.

A 30 nm plus 130 nm sample was mixed in a 10:1 ratio by volume (where 30 nm=10) to see if the Malvern instrument could differentiate the peaks. As shown in Figure 11, the separate peaks of the intensity of the standards are shown. Figure 12 shows the size distribution by volume percent. The IVDS analysis of the standards shows a full scale scan

in Figure 13, and an expanded scale scan in Figure 14. The IVDS instrument was able to show both PSL size standards.

2. CONCLUSION

The Malvern instrument was able to analyze monodispersed particles accurately. The Malvern instrument needs an approximate 3X difference in size to differentiate particles. The size determination in the instrument is by measuring Brownian motion in solution by Dynamic Light Scattering. The 3X difference is a theoretical limit for sizing for this technology.

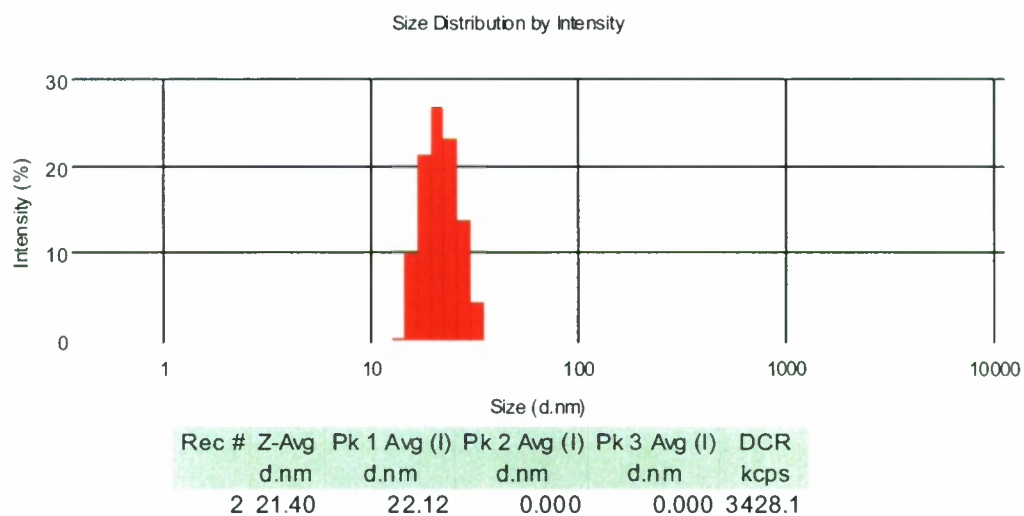


Figure 1. 20 nm PSL (Malvern)

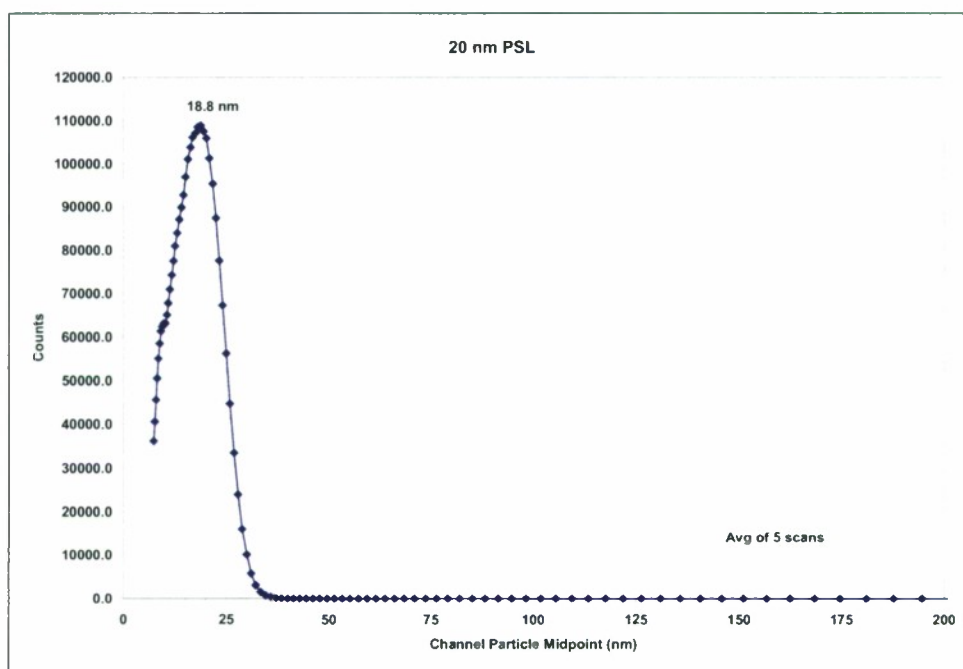


Figure 2. 20 nm PSL (IVDS)

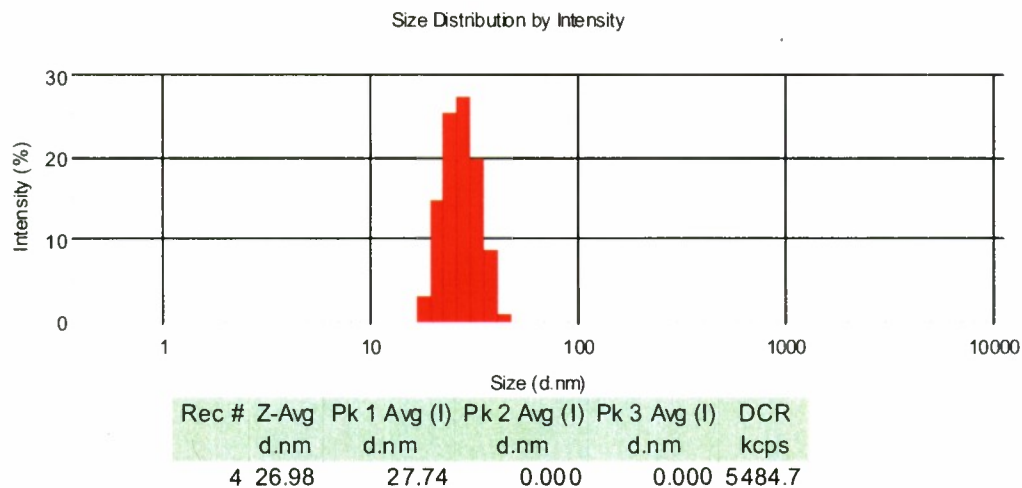


Figure 3. 30 nm PSL (Malvern)

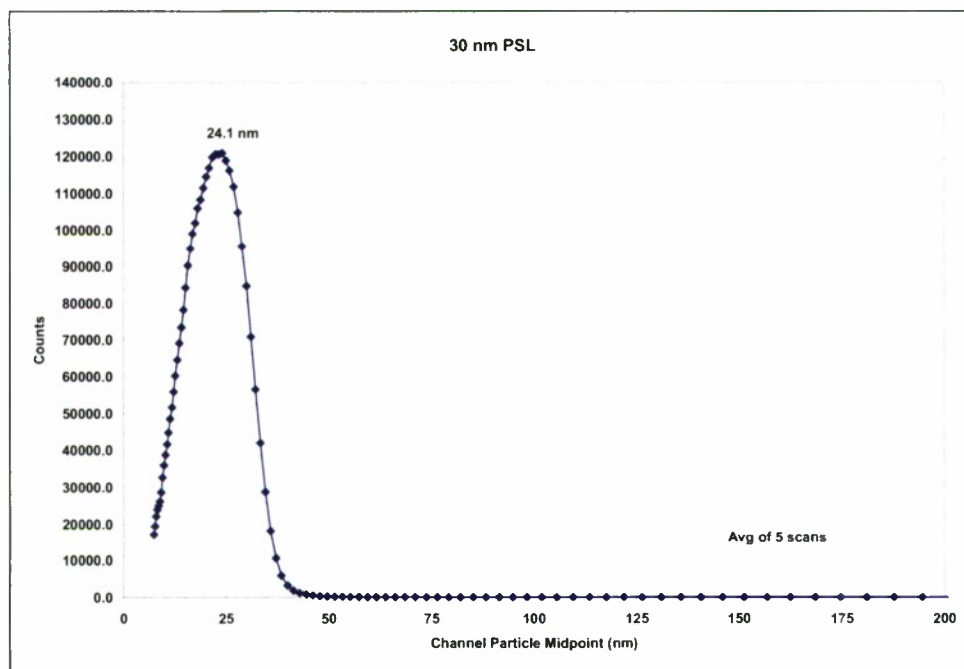


Figure 4. 30 nm PSL (IVDS)

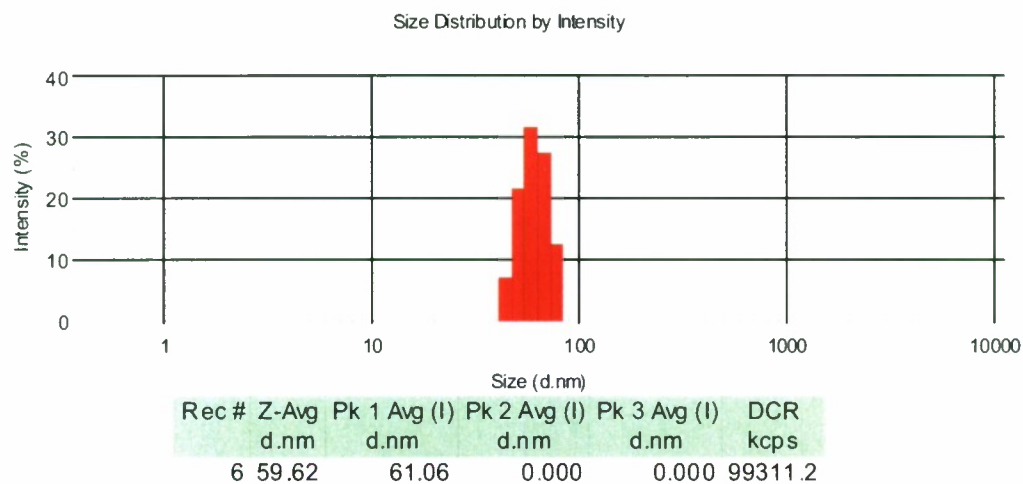


Figure 5. 70 nm PSL (Malvern)

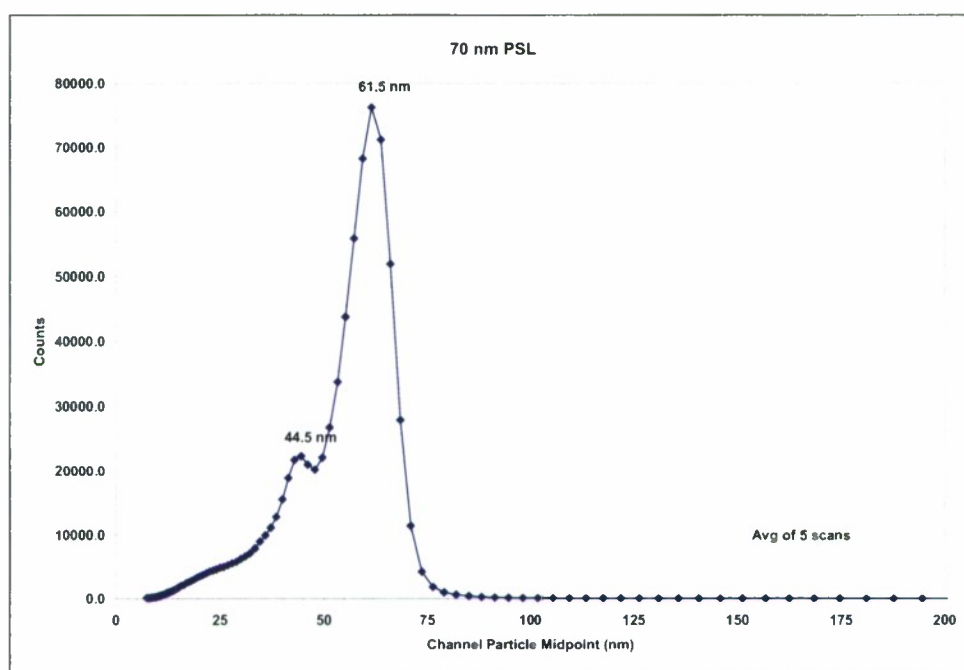


Figure 6. 70 nm PSL (IVDS)

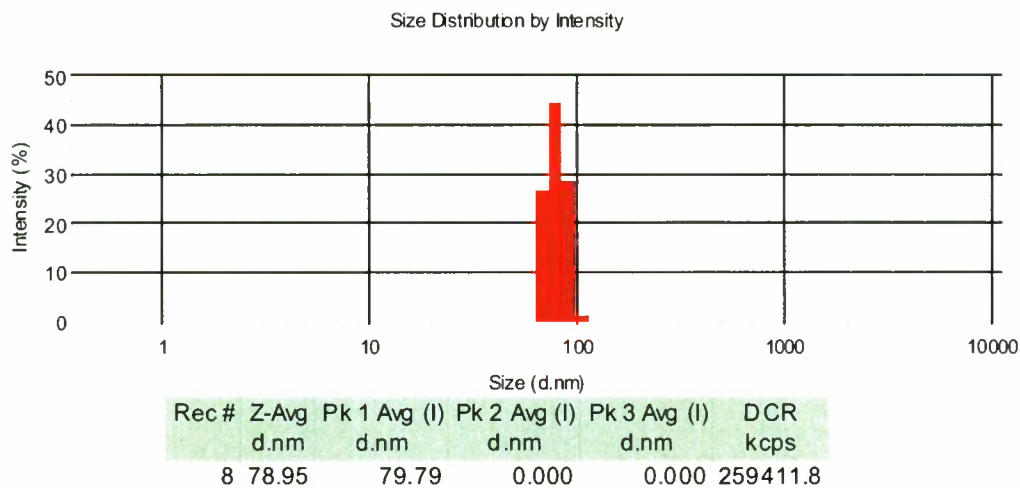


Figure 7. 90 nm PSL (Malvern)

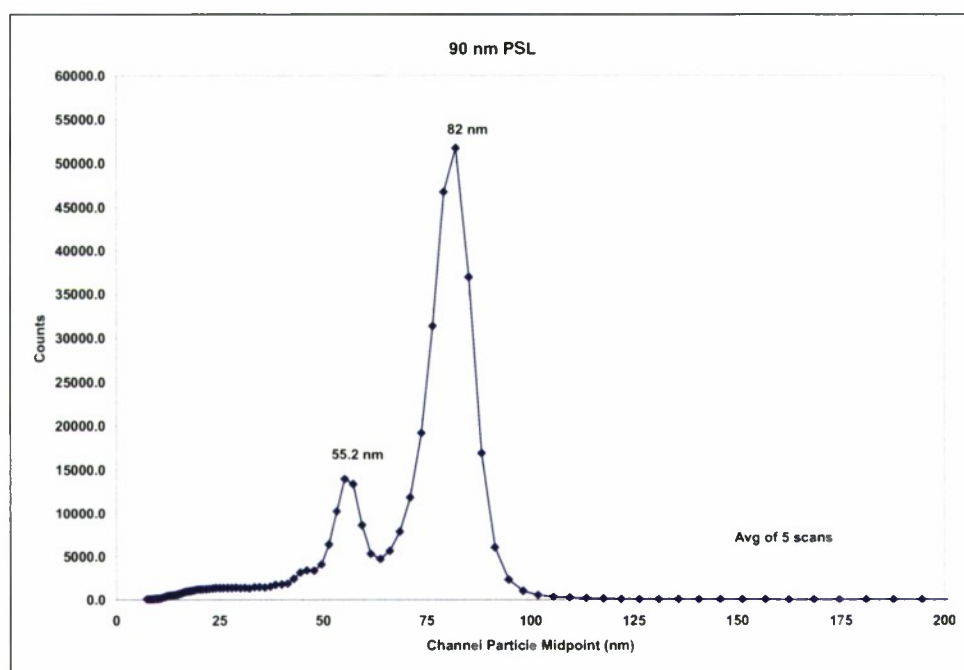


Figure 8. 90 nm PSL (IVDS)

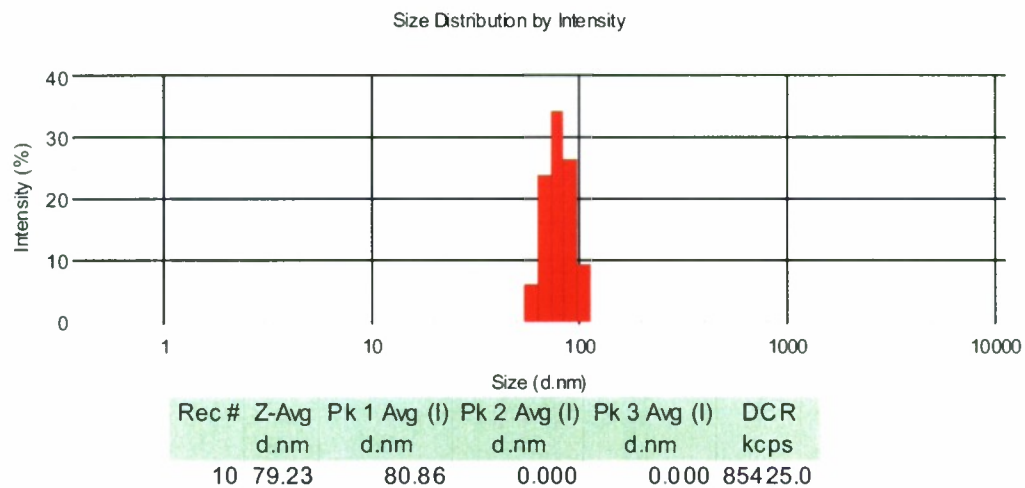


Figure 9. 30 nm Plus 90 nm PSL (Malvern)

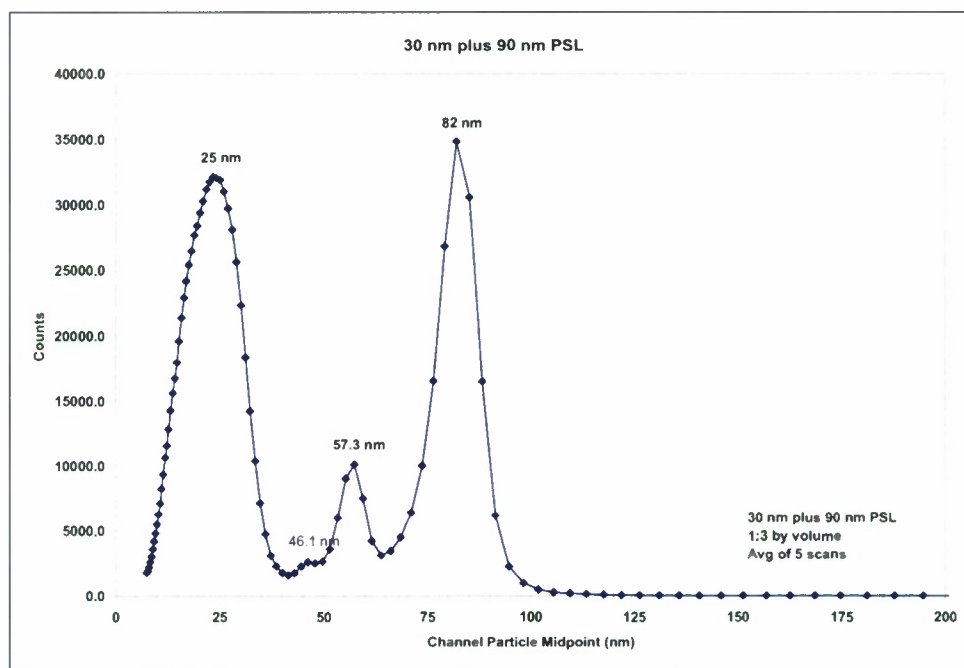


Figure 10. 30 nm Plus 90 nm PSL (IVDS)

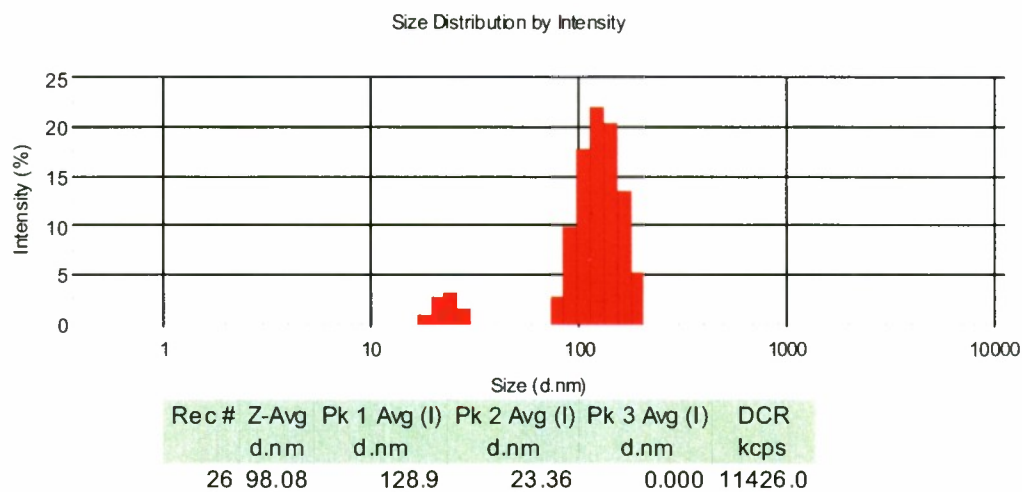


Figure 11. 30 nm Plus 130 nm PSL by Intensity (Malvern)

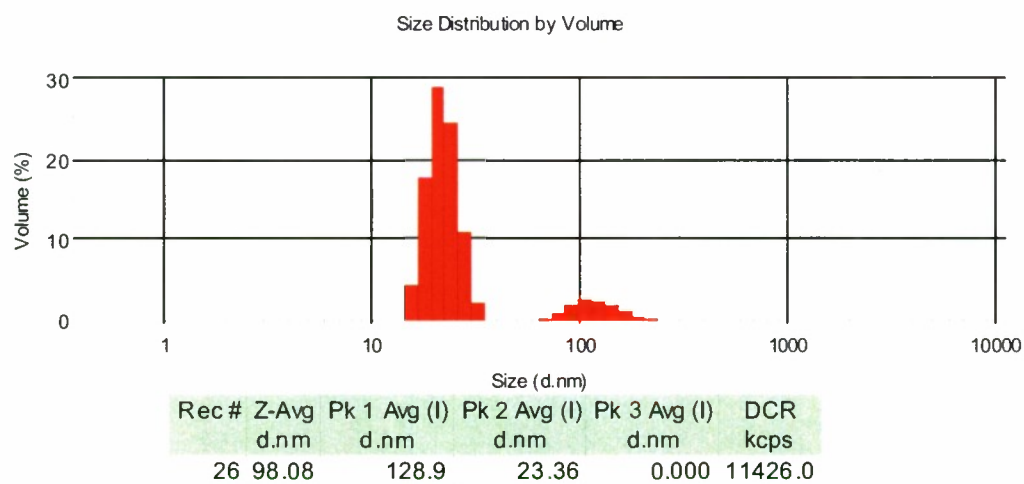


Figure 12. 30 nm Plus 130 nm PSL by Volume (Malvern)

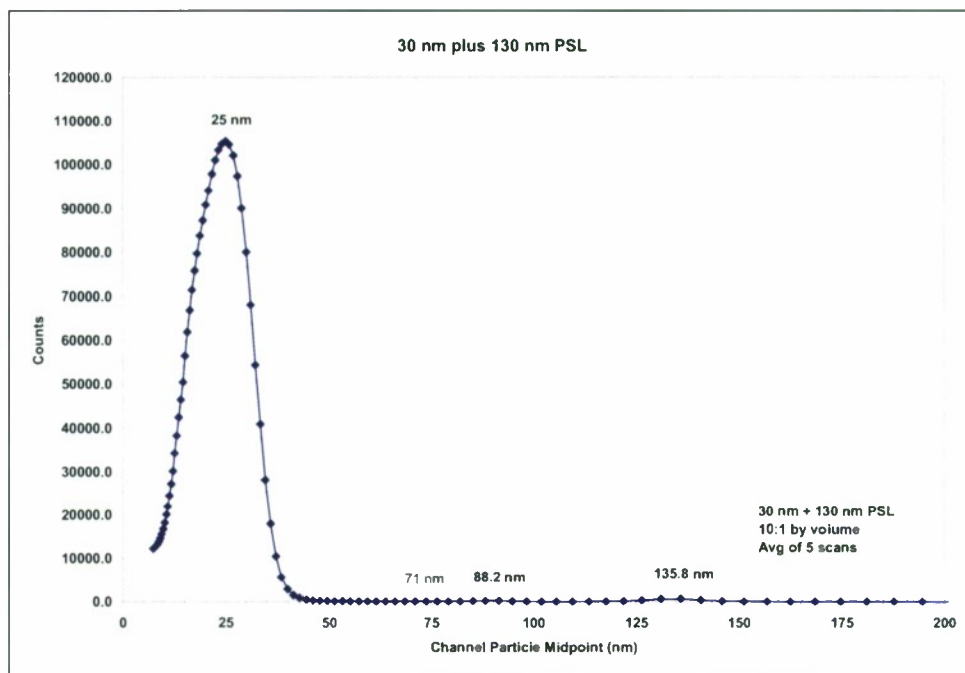


Figure 13. 30 nm Plus 130 nm PSL, Full Scale (IVDS)

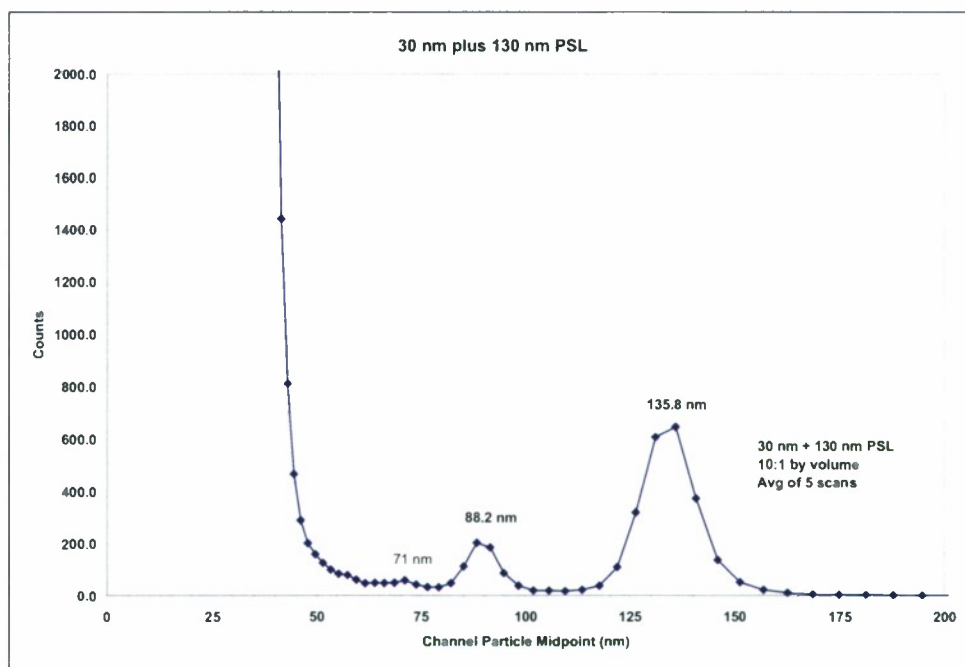


Figure 14. 30 nm Plus 130 nm PSL, Expanded Scale (IVDS)

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